

ORIGINAL  
FILE

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

In the Matter of:

Amendment of Section 2.106 of  
the Commission's Rules to  
Allocate the 1610-1626.5 MHz  
and the 2483.5-2500 MHz Bands  
for Use by the Mobile-Satellite  
Service, Including Non-  
geostationary Satellites.

ET Docket No. 92-28

RM-7771, RM-7773  
RM-7805, RM-7806

PP-29, PP-30  
PP-31, PP-32, PP-33

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## SUMMARY

Motorola Satellite Communications, Inc. ("Motorola") generally supports the proposals contained in the Commission's Notice of Proposed Rulemaking to allocate additional spectrum on a primary and secondary basis for LEO mobile-satellite services ("MSS"). Motorola also supports the additional allocations proposed for intersatellite services above 20 GHz. These allocations are fully consistent with the results reached at WARC-92, and their adoption into the domestic allocation tables will further United States interests.

These allocations, however, must be limited for the use by LEO systems. The proposed allocations constitute only about 40 percent of the spectrum that the United States has indicated is needed for LEO MSS. In fact, the 33 MHz of spectrum identified by the Commission in the NPRM is insufficient to meet the initial requirements of the five pending LEO MSS applicants. Geostationary MSS systems already have de facto allocations in adjacent spectrum, and a U.S. licensee has been authorized to operate in 28 MHz of spectrum. In addition, the U.S. MSS licensee cannot operate in the proposed frequency bands due to the uplink power limitations which the Commission intends to incorporate into the domestic allocation tables.

Motorola further demonstrates that the bands under consideration can support multiple access techniques by means of band segmentation. The marketplace, and not the Commission, should be the final arbiter of which access scheme will prevail.

Motorola's IRIDIUM™ system, with its FDMA/TDMA architecture, is the most spectrum efficient proposal before the Commission and only it can provide truly universal coverage to handheld portable terminals. FDMA/CDMA access techniques do not offer an acceptable method for co-frequency sharing by multiple LEO MSS systems.

Lastly, Motorola urges the Commission to reverse its tentative decision and grant to it a pioneer's preference for the innovative services and technologies associated with the IRIDIUM™ system. In particular, Motorola was the originator of the concept of a LEO satellite system primarily designed to provide personal mobile voice communications services to anyone, anywhere, anytime in the world using subscriber units that are small, lightweight, pocket-sized, battery-operated, and have low-profile antennas. Motorola has met all of the criteria established for awarding pioneer's preferences, and the Commission should grant its request in this proceeding.

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COMMENTS

Motorola Satellite Communications, Inc. ("Motorola") hereby submits these comments generally supporting the Commission's proposals in this proceeding to allocate spectrum for the mobile-satellite service ("MSS").<sup>1/</sup> There is a substantial need in the United States and throughout the world for spectrum in order to accommodate the expected demand for MSS services that will be offered, for the first time, by low-Earth orbit ("LEO") satellite systems, and the proposed allocations will help meet this demand.<sup>2/</sup>

<sup>1/</sup> See Notice of Proposed Rule Making and Tentative Decision, 7 FCC Rcd. 6414 (1992) (hereinafter "NPRM").

<sup>2/</sup> Motorola disagrees, however, with the Commission's tentative decision not to award it a pioneer's preference for the innovative features associated with its IRIDIUM™ system. As set forth below, Motorola believes that the Commission should grant its request for a pioneer's preference at the time it issues final rules in this proceeding. Motorola was the first to announce and proceed with the development of a LEO satellite system that will provide ubiquitous personal handheld communications services to all points in the United States and virtually all points in the world.

## I. INTRODUCTION

As the Commission is well aware, Motorola is one of six applicants proposing to offer MSS and radiodetermination satellite services ("RDSS") in the frequency bands under consideration in this proceeding.<sup>3/</sup> More than five years ago, Motorola embarked on a concentrated effort to design a revolutionary satellite system capable of meeting the RDSS and mobile communications needs of users around the world. The objective was to develop a global satellite system able to provide digital, portable, personal communications services to and from virtually anywhere in the world on a continuous basis. These efforts have culminated in the IRIDIUM™ system, which uniquely combines state-of-the-art cellular communications and digital networking technologies into a LEO satellite system.<sup>4/</sup> By placing a constellation of sixty-six satellites in six polar orbits at 780 kilometers above the Earth, and interconnecting the satellites with crosslinks, the IRIDIUM™ system will be able to

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<sup>3/</sup> In addition to Motorola, applications were timely filed by Loral Qualcomm Satellite Services, Inc. ("LQSS"), TRW, Inc. ("TRW"), Constellation Communications, Inc. ("Constellation"), Ellipsat Corporation ("Ellipsat"), and AMSC Subsidiary Corporation ("AMSC").

<sup>4/</sup> In December 1990, Motorola filed its application with the Commission to construct, launch and operate the IRIDIUM™ system. See Application of Motorola Satellite Communications, Inc. for IRIDIUM -- A Low Earth Orbit Mobile Satellite System, File Nos. 9-DSS-P-91(87) & CSS-91-010 (Dec. 3, 1990). Since that time, there have been several refinements in the satellite system design. In August 1992, Motorola submitted an amendment to its application which described these refinements and updated certain information in the application. See Minor Amendment to IRIDIUM™ System Application (August 10, 1992).

offer a full range of communications services to lightweight portable subscriber units located anywhere in the world. The IRIDIUM™ system will be capable of providing such services as geolocation, paging, messaging, voice, facsimile and data services to millions of users worldwide.

The IRIDIUM™ system design, in many respects, resembles the design of terrestrial cellular telephone systems. However, instead of having fixed cells and moving subscribers, the cells formed by the IRIDIUM™ system antenna beams will move at about 7,400 meters per second across the Earth's surface and the subscribers will remain relatively fixed. This design allows for significant frequency reuse and thereby makes considerably more efficient use of the frequency spectrum than current and other proposed mobile satellite systems. Utilizing cellular spot beam technologies and bidirectional transmissions, the IRIDIUM™ system is extremely spectrally efficient, able to serve about 4,000 simultaneous voice users in the United States and upwards of 1.8 million subscribers with just 10.5 MHz of L-band spectrum. In addition, due to the relative closeness of the IRIDIUM™ system satellites to the surface of the Earth, subscriber terminals will not need high power and directional antennas. Rather, IRIDIUM™ subscribers will be able to communicate with the satellite constellation with portable units having a short, low profile, omni-directional antenna and a maximum power output within all applicable health limits for portable phones.

Motorola supports the expeditious allocation by the Commission of spectrum for the provision of MSS within the United



States. The institution of this rule making proceeding by the Commission is a good beginning. The new MSS allocations, both primary and secondary, in the 1610-1626.5 MHz and 2483.5-2500 MHz bands in the United States are consistent with the decisions reached at the recently concluded 1992 World Administrative Radio Conference ("WARC-92"), and will further the leadership position of the United States in global portable communications. In addition, Motorola fully supports the additional allocations for intersatellite service above 20 GHz to accommodate crosslinks for MSS systems.

However, it is apparent that the proposed MSS allocations will be insufficient to meet current and future demands for LEO MSS and RDSS in this country. Indeed, the 33 MHz of L- and S-band spectrum under consideration in this proceeding is inadequate to meet the initial requirements of all of the LEO systems proposed by the pending applicants. It is for this reason that Motorola proposed in June of this year that the Commission consider additional MSS allocations for LEO systems.<sup>5/</sup> Specifically, Motorola has proposed that the Commission consider allocating, at least, an additional 10.5 MHz of uplink spectrum in two other segments of the L-band for use by

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<sup>5/</sup> Petition for Expedited Action, File Nos. 9-DSS-P-91(87), et al. (June 9, 1992). Motorola has recently renewed this request in a Petition for Rulemaking (Sept. 22, 1992), and also has requested that the Commission consider additional spectrum proposals in the upcoming negotiated rulemaking proceeding. See Comments of Motorola, CC Docket No. 92-166 (Sept. 14, 1992).

some of the current group of applicants.<sup>6/</sup> These proposed allocations were shown to be technically compatible with existing users in the bands and, when combined with the L- and S- band spectrum identified in this proceeding, would enable the Commission to license all qualified applicants with sufficient spectrum to meet their initial requirements. To date, no one has presented any technical or engineering data to contradict Motorola's findings in this regard.

II. THE PUBLIC INTEREST WOULD BE SERVED  
BY ALLOCATING THE PROPOSED BANDS FOR  
LOW-EARTH ORBIT SATELLITE SERVICES

In the NPRM, the Commission tentatively concludes, in accordance with the WARC-92 results, that spectrum should be made available for operation of MSS and RDSS services, and accordingly has proposed the establishment of new primary and secondary allocations in the 1610-1626.5 MHz and 2483.5-2500 MHz bands. Motorola is in basic agreement with the Commission's proposals. However, it believes that these bands should be limited to LEO systems. Geostationary ("GSO") MSS satellite systems already have been licensed in the United States and throughout the world with sufficient spectrum for, at least, their first generation systems, and Motorola does not believe that it is technically

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<sup>6/</sup> Alternatively, Motorola has proposed that the Commission dismiss and/or deny those applicants which are unqualified to be licensees due to technical, financial and legal impediments. See Consolidated Petitions to Dismiss and/or Deny and Comments of Motorola, File Nos. 15-DSS-MP-91, et al. (Dec. 18, 1991).

feasible for both LEO and GSO MSS systems to operate in the same frequencies.

A. The Proposed MSS Allocations Will Help Satisfy the Demonstrated Need for Spectrum by LEO MSS Satellite Systems

As Motorola explained in its original application and subsequent rule making petition, the ability of LEO satellite systems to offer primary voice and data services is critical to the future development of MSS as well as RDSS in the bands above 1 GHz.<sup>7/</sup> The proposed MSS allocations (1) will significantly advance the efficient use of the frequency spectrum; (2) will help foster United States competitiveness in international telecommunications generally and place the United States at the forefront of developments in LEO satellite technologies; (3) will promote the Commission's policy of fostering communications technologies that enhance the safety of life and property;<sup>8/</sup> and (4) are consistent with the decisions reached at WARC-92.

The bands under consideration currently are substantially underutilized. Although the Commission's original intent when it allocated these bands to RDSS was to license multiple dedicated RDSS systems to foster competition in the

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<sup>7/</sup> See IRIDIUM™ System Application, at 97-103; Motorola's Petition for Rulemaking, ET Docket No. 92-28, at 5-6 (Oct. 16, 1991).

<sup>8/</sup> Aeronautical Radio Inc., 5 FCC Rcd. 3038 (1990).

provision of radiolocation and radionavigation services,<sup>9/</sup> market demand has proved insufficient to support even one dedicated RDSS system. Instead, in the six years since the Commission's RDSS Licensing Order, no United States RDSS systems have operated in these bands.

The lack of interest in constructing and operating a dedicated RDSS satellite system, however, does not suggest any lack of demand for RDSS and MSS in the United States. Indeed, five of the six pending applications proposing operations in these bands have identified significant demand for both services. Motorola alone has projected a substantial demand for IRIDIUM™ system services by 2001, primarily from sparsely populated areas where there is insufficient demand to justify constructing terrestrial telephone systems, from areas in many developing countries with no existing telephone services, and from small urban areas that do not now have a terrestrial mobile communications infrastructure. The IRIDIUM™ system will also provide RDSS and ancillary services for such uses as safety of life, law enforcement, aviation, navigation, ground transportation, resource management and global paging.<sup>10/</sup> Several of the other LEO MSS applicants have identified similar

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<sup>9/</sup> See Amendment to the Commission's Rules to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 104 F.C.C.2d 650, 653 (1986) ("RDSS Licensing Order").

<sup>10/</sup> See IRIDIUM™ System Application, at 19-34.

demand for their proposed RDSS and MSS systems.<sup>11/</sup> These projections were later confirmed in a U.S. paper submitted to the Joint Interim Working Party in preparation for WARC-92, which concluded that 40.8 MHz of spectrum in each direction should be made available by the year 2001 just for LEO MSS systems to meet future demand.<sup>12/</sup>

**B.    Geostationary MSS Satellite Services  
Should Not Be Authorized in These Bands**

In this proceeding the Commission has proposed to allocate only an additional 16.5 MHz of spectrum in each direction for MSS, or only about 40 percent of the requirements for LEO MSS systems. It is clear that these allocations will be insufficient to meet current and future demands for LEO MSS in this country. Motorola alone needs at least 10.5 MHz in the 1616-1626.5 MHz band in order to meet its initial requirements. Most of the other LEO applicants have applied for the full complement of 33 MHz of spectrum. Even if these applicants could demonstrate an ability to share frequencies using FDMA/CDMA technologies without losing significant overall capacity -- a

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<sup>11/</sup> See Application of TRW, at 15-22 (May 31, 1991); Application of Constellation, at App. D (June 3, 1991); Application of LQSS, at 20-47 (June 3, 1991); Application of Ellipsat, at 15-24 (June 3, 1991).

<sup>12/</sup> Amendment of Section 6.1.1.3.1.4 on Spectrum Needs for Low Earth Orbit Mobile Satellite Communications Above 1 GHz, U.S. JIWP-16(Rev 1) (Jan. 31, 1991). A copy of this report is attached hereto as Attachment A. The JIWP Working Group 2 subsequently incorporated this report into its recommendations for total MSS spectrum requirements. See Document JIWP92/110-E (Mar. 12, 1991).

claim that has never been supported by any analysis and that Motorola has previously refuted<sup>13/</sup> -- the total available bandwidth still would not be sufficient to accommodate all of the proposed systems. Thus, it is imperative that the Commission not allow any of this spectrum to be allocated to non-LEO systems.<sup>14/</sup>

On the other hand, a GSO MSS system has already been licensed to AMSC in the United States to operate in 28 MHz of prime L-band spectrum.<sup>15/</sup> AMSC also has applied for authority to add to its satellites approximately 30 MHz of spectrum adjacent to its licensed frequency bands, in addition to its applications to add 20 MHz of spectrum in this proceeding.<sup>16/</sup>

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<sup>13/</sup> See, e.g., Motorola's Consolidated Petitions to Dismiss and/or Deny; Motorola's Reply Comments, File Nos. 15-DSS-MP-91, et al. (Jan. 31, 1992); Motorola's Consolidated Response, File Nos. 15-DSS-MP-91, et al. (March 27, 1992). None of the CDMA applicants has presented any information or analysis as to the combined capacity of co-frequency FDMA/CDMA systems.

<sup>14/</sup> Motorola believes that GSO and LEO MSS systems cannot operate on the same frequencies without causing unacceptable levels of interference within each system or without suffering substantially reduced capacities. GSO user-to-satellite links contain much more power than LEO links, thereby causing excessive signal levels in the LEO satellite receivers.

<sup>15/</sup> See Memorandum Opinion, Order and Authorization, 4 FCC Rcd. 6041 (1989), reversed in part Aeronautical Radio, Inc. v. FCC, 928 F.2d 428 (D.C. Cir. 1991), reaffirmed in Final Decision on Remand, 7 FCC Rcd. 266 (1992), appeal pending.

<sup>16/</sup> See Request for Modification and Supplemental Information of AMSC, File Nos. 7/8/9-DSS-MP/ML-90 (Dec. 4, 1989). Any difficulties that AMSC may currently be having in coordinating spectrum is irrelevant since presumably each LEO system will also have to be coordinated internationally once licenses are awarded by the Commission.

Furthermore, the 1610-1626.5 MHz and 2483.5-2500 MHz bands are particularly well suited for international MSS operations such as the IRIDIUM™ system. As a result of the decisions reached at WARC-92, these bands have been allocated internationally, with limited exceptions, for MSS. AMSC's proposed operations are limited to Region 2 due to the location of its satellites and beam configurations, and will not be able to serve the handheld portable market due to power limitations. Accordingly, GSO MSS systems, such as AMSC's, would not be able to utilize effectively the international MSS allocations adopted at WARC-92 for these bands.

Moreover, GSO MSS systems, such as AMSC's, will be unable to meet the uplink EIRP spectral density limits established at WARC-92 for the 1610-1626.5 MHz band. In its NPRM, the Commission has proposed to adopt these limits into the domestic allocation tables.<sup>17/</sup> The Commission should not authorize any GSO satellite system for operation in these bands if such a system cannot comply with the applicable international Radio Regulations, or which is otherwise incompatible with RDSS systems operating in the bands.<sup>18/</sup>

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<sup>17/</sup> In this regard, Motorola supports the adoption of proposed Footnote 731X. As set forth in Motorola's application, as amended, the IRIDIUM™ system meets the -3 dBW/4 kHz limit applicable to the 1616-1626.5 MHz band.

<sup>18/</sup> AMSC's application does not even propose "true" RDSS. The Commission's rules define "radiodetermination" as:

The determination of the position, velocity and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation  
(continued...)

III. MOTOROLA'S FDMA/TDMA DESIGN IS  
SUPERIOR TO THE ACCESS METHODS  
OF THE OTHER PROPOSED LEO SYSTEMS

The NPRM requests comments directed toward the relative merits of the various access methods proposed by the five LEO applicants, and in particular, whether any of them can support service by multiple LEO licensees, or whether it is feasible to permit multiple access methods in the same spectrum. NPRM at ¶ 19. Motorola is of the view that the bands under consideration can support at least two systems by means of band segmentation, but that in any event, due to the limited amount of spectrum available, the Commission should award licenses first to those qualified applicants that have proposed the most spectrally efficient systems.

A. The IRIDIUM™ System is the Most Spectrum  
Efficient Proposal Before the Commission

Motorola's FDMA/TDMA system architecture, with its multiple spot beam configuration and bidirectional operations, is more spectrum efficient than any of the other LEO and GSO MSS

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<sup>18/</sup> (...continued)  
properties of radio waves.

See 47 C.F.R. § 2.1(c) (1990). Instead, AMSC indicates that it will provide position location service through the use of the government's Global Positioning System ("GPS"). AMSC Application, at 5-6 (June 3, 1991). AMSC proposes to relay to its subscribers the position data generated by means of another satellite system and use of a separate circuit. The Commission already has concluded that the relaying of processed GPS information is different from RDSS. See RDSS Licensing Order, 104 F.C.C.2d at 659.



satellite systems before the Commission. Each of the other proposed systems has severe capacity limitations as a result of limited or nonexistent reuse capabilities, as well as coverage and/or power problems. Nevertheless, based upon the channel capacities claimed by the other applicants in their filings with the Commission,<sup>19/</sup> it is apparent that on a user-per megahertz basis, the IRIDIUM™ system is far superior to any of the other proposed systems. As shown on the following table, none of the other unidirectional systems even approaches the spectrum efficiency over CONUS of the IRIDIUM™ system.

CLAIMED CONUS CHANNEL CAPACITIES							
	IRIDIUM	LORAL		TRW	ELLIPSAT	CONSTEL- LATION	AMSC
		A	B				
Requested Service Bandwidth (MHz)	10.5	16.5	16.5/ 16.5	16.5/ 16.5	16.5/ 16.5	2/16.5	10/10
Total Service Bandwidth (MHz)	10.5	16.5	33	33	33	18.5	20
Claimed CONUS Channel Capacity	4720	5900	6500	4600	1210	100	3000
Spectrum Efficiency (Channels/MHz)	450	358	197	139	37	5	150
Percent of IRIDIUM-System Capacity	100	80	44	31	8	1	33

**B. Only the IRIDIUM™ System Can  
Provide Truly Universal Coverage  
to Handheld Portable Terminals**

Only the IRIDIUM™ system can serve handheld units located at all points in the United States and virtually all

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<sup>19/</sup> The actual capacities of many of these proposed systems is much lower than the numbers contained in their respective applications. See Motorola's Consolidated Petitions to Dismiss and/or Deny 35 - 40 (Dec. 18, 1991).

points elsewhere in the world with an adequate signal and associated link margins. All of the other proposed LEO MSS systems have limitations which severely restrict their ability to provide continuous RDSS and MSS to handheld units in the United States.

In its previous filings commenting upon and opposing the applications of the other applicants, Motorola demonstrated that none of the other MSS applicants would be able to provide continuous voice coverage to handheld terminals over the entire United States during unobscured and shadowed conditions at claimed capacities.<sup>20/</sup> Only the IRIDIUM™ system was shown to be able to provide continuous coverage of the United States to handheld portable as well as mobile subscriber units.

C. CDMA Does Not Offer an Acceptable Method for Co-Frequency Sharing of Spectrum by Multiple Non-Homogeneous LEO MSS Systems

For the last eighteen months, Motorola has attempted to eradicate the "ghost" of CDMA limitless spectrum sharing. CDMA does not permit unlimited sharing among non-homogeneous, or even homogeneous systems. Nor are CDMA/spread spectrum multiple access techniques superior to other modulation schemes for purposes of efficiently utilizing available spectrum in the satellite environment. This ghost, like most other fictitious objects, has been difficult to capture due to its ever changing

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<sup>20/</sup> See Motorola's Consolidated Petitions to Dismiss and/or Deny, at 18-26.

forms and the lack of any hard evidence to support its existence.

In fact, none of the other LEO applicants propose operations using purely CDMA access methods. All of them use a combination of FDMA and CDMA. For example, Constellation's proposed operations consist of 500 kHz uplink channels operating on an FDMA basis in the L-band and CDMA downlinks in the S-band. Ellipsat and LQSS propose 1.4 MHz and 1.25 MHz channels, respectively, for both their uplink and downlink transmission channels within which they will operate on a CDMA basis, while TRW has proposed CDMA operations within three 4.83 MHz channels.

Nor does CDMA modulation permit unlimited numbers of homogeneous satellite systems to use the same spectrum. Even identical RDSS-only spread spectrum systems operating in the same frequency band have overall capacity limitations. Indeed, the Commission has recognized that such trade-offs exist, including reduced channel throughput, in pursuing multiple entry policies.<sup>21/</sup>

FDMA/CDMA modulation techniques have no inherent sharing advantage over other modulation/access techniques in the satellite field. As demonstrated above, FDMA/CDMA is not the most spectrum efficient modulation technique for satellite systems, it does not provide multiple access without severe capacity limitations, and most importantly, it is not the panacea that the Commission originally envisioned when the RDSS rules were first adopted. Even proponents of FDMA/CDMA access techniques recognize the inefficiencies, interference problems

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<sup>21/</sup> See RDSS Licensing Order, 104 F.C.C.2d at 654.

and increased costs associated with using such modulation techniques for satellite systems.<sup>22/</sup> A consultant to Motorola further reported that:

(1) CDMA has significant limitations as to spectrum sharing between multiple operational satellite systems. CDMA spectrum sharing will have a maximum capacity limited by inter- and intra-system code noise and has been shown by others to provide less channel efficiency than TDMA/FDMA.

(2) CDMA is a spectrum sharing method more useful between multiple homogeneous operational satellite systems. Such homogeneity would require an unprecedented degree of technical standardization between the applicants and significant technical changes to several of the current applications.<sup>23/</sup>

In its earlier pleadings, Motorola demonstrated that FDMA/CDMA is not a panacea, and that other modulation techniques, such as FDMA/TDMA, offer greater capacity and spectrum utilization advantages. Motorola also showed that the current group of FDMA/CDMA applicants cannot feasibly operate on a co-frequency basis at stated capacities due to unacceptable levels of intersystem and intrasystem interference.<sup>24/</sup> It has yet to

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<sup>22/</sup> See Motorola's Consolidated Opposition, at Appendix A (July 3, 1991), citing A.J. Viterbi, When Not to Spread Spectrum -- A Sequel, IEEE - Mag. (April 1985). LQSS previously questioned Motorola's use of this article; however, the comments of Mr. Viterbi speak for themselves.

<sup>23/</sup> See Motorola's Consolidated Opposition, at Appendix A; Motorola's Consolidated Petitions to Dismiss and/or Deny, at 42-50.

<sup>24/</sup> Id.

be shown that the FDMA/CDMA applicants can share spectrum on a co-frequency basis.<sup>25/</sup>

D.    The Commission Can Accommodate  
      Multiple Entry and Multiple Access  
      Methods by Means of Band Segmentation

The Commission should be able to grant multiple systems without adopting any single modulation technique as a standard. For example, Motorola has previously demonstrated how the Commission could authorize Motorola to operate in the 1616-1626.5 MHz portion of the band, and still have sufficient available bandwidth (22.5 MHz) for one or two of the other proposed systems.<sup>26/</sup> In each discrete portion of the band, licensees

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<sup>25/</sup> Although several of the FDMA/CDMA applicants have attempted to refute Motorola's assertions, a careful reading of their conclusions reveals many areas of apparent agreement with Motorola's analysis. None of the other LEO MSS applicants appears to dispute Motorola's assertion that there is a maximum communications capacity attainable for any particular CDMA technical environment which is generally dependent on EIRP and bandwidth. See, e.g., TRW Opposition, Tech. App. A at 22 (Jan. 31, 1992); Ellipsat Opposition, Exh. A at 7 (Jan. 31, 1992). And LQSS concedes that only a "properly designed" CDMA/spread spectrum system can share spectrum and enable several systems to operate simultaneously, and that homogeneity among multiple systems will result in more efficient spectrum sharing. See LQSS Opposition, Tech. App. at 48-50 (Jan. 31, 1992). LQSS and Dr. Viterbi indicate that they are in essential agreement with Motorola that in order to implement a homogeneous environment, significant changes would have to be made to the pending FDMA/CDMA applications to harmonize spacecraft antenna gain, total power transmitted by each mobile unit, and coordination of CDMA codes. See LQSS Opposition, Tech. App. B-3, and Tech. App. A at 52. None of the other FDMA/CDMA systems can realize the asserted benefits of such homogeneity due the vast differences in their respective design concepts.

<sup>26/</sup> See Motorola's Reply Comments, File Nos. 15-DSS-MP-91, et al. (Jan. 31, 1992). If the Commission desires to license more  
(continued...)

would be able to utilize the modulation technique that is best suited for its system design and business plan. In this way, the Commission could promote entry by more than one applicant without having to choose between modulation schemes.

The Commission should not apply its open entry policies purely for the sake of more potential or theoretical competition. It needs to recognize that both marketplace and interference considerations place practical limits on the number of viable systems that can operate in these bands, even if other systems were able to operate co-frequency as claimed. While competition is one factor which may be considered by the Commission as part of its public interest equation, it is not the only factor.<sup>27/</sup> Moreover, granting two permits to provide MSS in these bands, coupled with the previous assignments to AMSC of frequencies to provide MSS, will ensure adequate competition.

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<sup>26/</sup> (...continued)

LEO MSS satellite systems, it must allocate additional spectrum. Motorola has proposed two alternative bands for future MSS allocations. See Motorola's Petition for Rulemaking (Sept. 22, 1992). Acceptance of either one of these options would enable the Commission to license additional systems.

<sup>27/</sup> As the Supreme Court stated some time ago, "encouragement of competition as such has not been considered the single or controlling reliance for safeguarding the public interest." FCC v. RCA Communications, Inc., 346 U.S. 86, 93 (1953). Rather, the Court noted that while competition may be a relevant factor in weighing the public interest, it is not the only factor to be considered by the Commission when considering entry issues. In the Court's words, there must be a "reasonable expectation that competition may have some beneficial effect." Id. at 97. See also ITT World Communications, Inc. v. FCC, 725 F.2d 732, 747 n.33 (D.C. Cir. 1984) (Competition is "not an end in itself" and "is important only as a means of furthering the public interest."); United States v. FCC, 652 F.2d 72, 82 (D.C. Cir. 1980) (en banc) ("[C]ompetition is but one element of a determination of the public interest.").

The Commission may not abdicate its regulatory duty in favor of unlimited competition, if such a policy would not serve the public interest.<sup>28/</sup> Rather, the Commission must strike a proper balance between the potential benefits of competition and other relevant interests in promoting the public good, such as the optimal allocation and utilization of scarce spectrum resources.<sup>29/</sup>

IV. COMPLIANCE WITH INTERNATIONAL RR 2613 FOR GATEWAYS DOES NOT PRESENT ANY OPERATIONAL PROBLEMS FOR THE IRIDIUM™ SYSTEM

Motorola does not anticipate that international Radio Regulation 2613 will have any appreciable effect upon the operation of IRIDIUM™ system gateway facilities.<sup>30/</sup> Motorola's

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<sup>28/</sup> See Telocator Network of America v. FCC, 691 F.2d 525, 548-50 (D.C. Cir. 1982).

<sup>29/</sup> In defending its wireline/nonwireline allocation plan against anticompetitive arguments, the Commission recognized "that our statutory responsibilities require us to weigh and balance competing objectives relating to the public interest, including, for example, optimal allocation of scarce spectrum resources." Cellular Communications Systems, 89 F.C.C.2d 58, 72 (1982).

<sup>30/</sup> As a result of WARC-92, RR No. 2613 now provides that:

Non-geostationary space stations shall cease or reduce to a negligible level their emissions, and their associated earth stations shall not transmit to them, whenever there is insufficient angular separation between non-geostationary satellites and geostationary satellites resulting in unacceptable interference to geostationary-satellite space stations in the fixed-satellite service operating in accordance with these Regulations.

application, as amended, as well as its IFRB submissions, indicate an intention to comply with all international Radio Regulations, including RR No. 2613.

Motorola's feeder link operations will be able to coexist with GSO operations in the same bands by using certain well-recognized avoidance techniques, such as geographic, time and frequency separation, when transmitting and receiving signals to and from associated LEO satellites. Last year, the U.S. JIWP submitted a paper to the ITU identifying several of these techniques.<sup>31/</sup>

V. HUMAN HEALTH ASPECTS OF  
MOBILE SATELLITE HANDHELD RADIOS

The Commission has asked for comments on the potential for MSS LEO devices not to be in compliance with applicable radio frequency ("R.F.") exposure guidelines, and in particular, whether such devices could create R.F. fields that may be harmful to human health. NPRM at ¶¶ 31-32. As a general matter, Motorola believes that mobile satellite handheld radio devices can be safely operated with confidence, provided that adherence is given to the relevant standards for the safe exposure of humans to R.F. energy.

The Commission has heretofore used the ANSI C95.1 1982 Standard as a basis for its regulation of R.F. devices. This

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<sup>31/</sup> See "LEO Feederlink Avoidance of the GSO in the Fixed Satellite Service (FSS)," Doc. No. U.S. JIWP-27 (Feb. 5, 1991).



standard was updated by the IEEE in IEEE C95.1 1991,<sup>32/</sup> and was recently adopted by ANSI as a replacement for its 1982 standard. Motorola fully supports the use of this ANSI/IEEE standard by the Commission as it relates to mobile satellite handheld radio devices.

The ANSI/IEEE standard was developed by a broad-based group of experts, representing, among others, academia, the Government, and industry. The work of this group was based, in substantial part, upon important scientific criteria such as peer-reviewed papers, reproducible results, and dosimetric quantifiability. Furthermore, the ANSI/IEEE standard is consistent with the work of other respected national and international standards bodies, such as the National Council on Radiation Protection and Measurements ("NCRP"), the World Health Organization ("WHO"), the International Radiation Protection Association ("IRPA"), and the International Non-Ionizing Radiation Committee ("INIRC"). It thus represents a sound basis upon which to prescribe regulations for the R.F. safety of mobile satellite devices.

Moreover, Motorola believes that the Commission is the appropriate agency to regulate human health aspects of mobile satellite handheld radio devices so long as the Commission bases its regulations on a credible standard developed by others, such as that published by ANSI/IEEE. In addition, the Commission should seek and use the advice of other agencies which have

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<sup>32/</sup> IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (C95.1-1991).